TOW CONTROL HANDLE FOR UNMANNED AERIAL VEHICLE

BACKGROUND

Unmanned aerial vehicles are continuing to increase in use. For example, unmanned aerial vehicles are often used for surveillance. There is also discussion of electronic-commerce retailers, and other entities, delivering items directly to a user's home using unmanned aerial vehicles. While there are various known uses for unmanned aerial vehicles, certain techniques for controlling the unmanned aerial vehicles are relatively limiting with respect to other uses. For example, current hand-operated remote controls for automated aerial vehicles are not conducive to users being able to operate the remote controls while simultaneously utilizing their hands for other purposes.

BRIEF DESCRIPTION OF THE DRAWINGS

The detailed description is described with reference to the accompanying figures. In the figures, the left-most digit(s) of a reference number identifies the figure in which the reference number first appears. The use of the same reference numbers in different figures indicates similar or identical components or features.

FIG. **1** is a diagram of a towing system including a tow control handle as held by a user and as attached by a tow line to an unmanned aerial vehicle, according to some implementations.

FIGS. **2**A-**2**C are diagrams of top, end and front views of a tow control handle, according to an implementation.

FIG. **3** is a diagram of a user device that is utilized in conjunction with an unmanned aerial vehicle and tow control handle, according to an implementation.

FIG. **4** is another diagram of a tow control handle, according to an implementation.

FIG. **5** is another diagram of a user device, according to an implementation.

FIG. **6** is a block diagram of an illustrative implementation of a handle control system that may be used with various implementations.

FIG. **7** is a block diagram of an illustrative implementation of a user device control system that may be used with various implementations.

FIG. **8** is a block diagram of an unmanned aerial vehicle configuration, according to an implementation.

FIG. **9** is a block diagram of an illustrative implementation of an unmanned aerial vehicle control system that may be used with various implementations.

FIG. **10** is a flow diagram illustrating an example process for towing a user, according to some implementations.

FIG. **11** is a flow diagram illustrating an example towing control sub-process, according to some implementations.

FIG. **12** is a block diagram of an illustrative implementation of a server system that may be used with various implementations.

While implementations are described herein by way of example, those skilled in the art will recognize that the implementations are not limited to the examples or drawings described. It should be understood that the drawings and detailed description thereto are not intended to limit implementations to the particular form disclosed but, on the contrary, the intention is to cover all modifications, equivalents and alternatives falling within the spirit and scope as defined by the appended claims. The headings used herein are for organizational purposes only and are not meant to be used to limit the scope of the description or the claims. As used throughout this application, the word "may" is used in a permissive sense (i.e., meaning having the potential to), rather than the mandatory sense (i.e., meaning must). Similarly, the words "include," "including," and "includes" mean "including, but not limited to."

DETAILED DESCRIPTION

This disclosure describes a towing system including a tow control handle that is attached by a tow line to an unmanned aerial vehicle ("UAV"). The tow control handle may include various control elements (e.g., sensors, buttons, switches, rotatable portions, etc.) that may be activated by a user to provide control signals that are utilized for controlling various aspects of the flight of the UAV. For example, a first control element may provide a first control signal that is utilized to control a direction of the UAV, while a second control element may provide a second control signal that is utilized to control a speed of the UAV. Additional control elements may be utilized to control additional aspects of the flight of a UAV (e.g., a flying height, an autopilot function, etc.)

In various implementations, the tow control handle may include left and right hand engagement areas where a user's left and right hands grip the tow control handle. Certain control elements (e.g., buttons, switches, etc.) may be located between the left and right hand engagement areas, so as to allow operations to be performed with a user's thumbs or adjacent fingers while the user continues to grip the left and right hand engagement areas with the user's other fingers. One or more control elements may also be located on end portions of the tow control handle that are outside of the hand engagement areas, so as to reduce the likelihood of accidental pressing or other actuation of the control elements while the user is gripping the tow control handle. In various implementations, the hand engagement areas may include one or more sensors that are configured to indicate when a user has released the tow control handle.

In various implementations, the towing system may also include a user device that is configured to be worn or otherwise carried by the user. For example, the user device may be worn on a user's wrist, arm, leg, or may be carried in a user's pocket, etc. In various implementations, the user device may include one or more control elements (e.g., buttons, switches, etc.) which a user may activate in order to wirelessly transmit various instructions to the UAV. For example, a summoning instruction may be wirelessly transmitted to summon the UAV to fly to a user's location to enable the user to engage the tow control handle and begin a towing process. As another example, a departure instruction may be transmitted to direct the UAV to fly to a designated location after the user has released the tow control handle.

In various implementations, the UAV may also include capabilities for avoiding obstacles during the towing process. For example, the UAV may utilize sense and avoid procedures for avoiding obstacles that are detected or otherwise determined along a flight path for the UAV during a towing process. As another example, the UAV and/or tow control handle may include capabilities for detecting obstacles in a travel path of the user and/or tow line during the towing process, for which the UAV may be flown so that the tow line and the user avoid the obstacles. In various implementations, a designated travel area may be determined, and the flying of the UAV may be controlled to prevent at least one of the UAV or the user from traveling